# ELWHA RIVER CHUM SALMON SURVEYS:

# 1993-1994

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## ABSTRACT

We conducted weekly spawner surveys for Elwha River chum salmon from November 2, 1993, through January 14, 1994, in conjunction with the Lower Elwha Tribal Fisheries Office. Our objective was to collect information necessary for the enhancement of the existing Elwha River chum salmon stock in preparation for removal of the Elwha River dams. We surveyed the mainstem from river km 0.0 to 5.0 by raft or drift boat and all wetted side channels within this reach by foot. Chum were first observed on November 2 and last observed on January 7. Based on live/dead ratios and redd counts, peak spawn-timing may occur from late October through the first week of December, with a possible subpeak in late December. A total of 62 fish (including tribal samples) was subjected to electrophoretic analysis; preliminary results indicated that the early segment of the run may be of pure native origin, while later returning fish may be a hatchery/native hybrid stock. The total number of chum observed was 230, with a peak weekly abundance of 43 spawners. An area-under-the-curve analysis yielded a run size estimate of 153. Spawner distribution was concentrated primarily in the lower half of the survey reach, with high use (when accessible) in a left-bank side channel at river km 2.8 (a former WDFW index reach). This side channel contained excellent chum salmon habitat. Abundant instream and riparian cover was available, and substrate consisted primarily of gravel and cobble. However, this channel appeared inaccessible at low flows because of two migratory barriers near its downstream entrance. It is still unclear whether the existing Elwha chum salmon run is native or non-native, whether there are two distinct stocks, what the entry and spawn timings are, and the exact size of the present-day run. Spawner surveys should be continued for a full cycle (four years) to help answer these questions as an enhancement strategy is formulated.

# INTRODUCTION

In October 1992, the "Elwha River Ecosystem and Fisheries Restoration Act" was signed into law. The goal of the act is the "full restoration of the Elwha River ecosystem and native anadromous fisheries", to be accomplished by the removal of the Elwha River dams (U.S. Department of the Interior (USDI) et al. 1994). Ten anadromous fish stocks, including chum salmon, were historically present in the Elwha River basin prior to construction of the dams. The current fish restoration plan (USDI et al. 1994) provides prioritized options for the full restoration of all Elwha River anadromous fish stocks, assuming the dams will be removed.

The primary option proposed for restoring Elwha chum salmon is broodstock development for juvenile outplanting, focusing on any identifiable native component as a first priority in brood collection (USDI et al. 1994). However, the genetic status and current abundance of the Elwha chum is unknown. Limited electrophoretic sampling in 1985 (S. Phelps; Washington Department of Fish and Wildlife (WDFW); personal communication; May 20, 1992) suggested that the Elwha hatchery chum were similar to Walcott-Slough (Quilcene National Fish Hatchery) stock, which was used as a parent stock by the Lower Elwha Tribe (LET) in its hatchery chum release program.

The LET hatchery program began in 1976 and continued through 1985 (LET Fisheries Office 1994). During that period, over 11 million fry were reared and released into the Elwha River. Eggs and milt originated from three sites and two genetic sources. The majority of egg and milt transfers were from Quilcene National Fish Hatchery (Wolcott Slough stock); with additional transfers from the Lyre River (Lyre River stock), crossed with Walcott Slough origin eggs in 1978, and the Skokomish Tribe's Enatai Creek Hatchery (green and eyed eggs, Wolcott Slough stock). These stocks were utilized only through 1978, after which milt and eggs were taken strictly

from Elwha River adult returns (hatchery rack returns and in-river capture of adults). Presumably, adult returns were mostly from the heavily imported Walcott-Slough stock.

Elwha Tribal hatchery returns began in 1979, peaked in 1980, and declined until monitoring ended in 1989. The hatchery chum release program was discontinued following the 1985 brood year due to limited returns, difficult capture conditions for in-river tribal fishers, and a desire to shift hatchery operations towards a species of salmon with higher economic value (LET Fisheries Office 1994).

## PURPOSE

The purpose of this study was to collect information necessary for the stabilization and enhancement of the existing Elwha chum salmon stock, so that suitable brood will be available for successful re-introduction to the upper watershed following dam removal.

Information proposed for collection included: electrophoretic sampling of 100 fish to determine the genetic components of existing Elwha chum; scale collection from spawnouts to determine age at return; date and location of spawner observations; and evaluation of opportunities for chum habitat improvement. This work was a cooperative endeavor with the LET Fisheries Office, which monitored the tribal coho and steelhead fisheries for incidental chum captures, assisted with supplemental spawner surveys, and arranged for all electrophoretic analyses.

## METHODS

Weekly spawner surveys were conducted from November 5, 1993, through January 14, 1994, except during high river flows. A small inflatable raft or a drift boat was used to float the mainstem from the one-way bridge to the hatchery outfall (Figure 1). All side channels within this reach were surveyed by foot. This reach was believed to represent the limit of present-day spawner distribution. A supplemental survey of side channels was attempted above the one-way bridge near river km (rkm) 6.0 on December 10, 1993 (an expected high-spawner-abundance period) to determine whether any spawning occurred above our routine survey reach, but due to poor visibility and high flows this supplemental survey was not possible.

During each survey, live and dead (i.e., spawned-out) chum were tallied and their location recorded, as were chum redds. Tissue samples were collected from accessible (i.e., retrievable) spawned-out chum. Samples were collected from the heart, liver, muscle, and eye, and placed in glass tubes on ice. Samples were then transported to the LET hatchery, where they were frozen and sent to WDFW for analysis. Scale samples were also collected from each spawnout and supplied to LET for possible future use in discriminating stock-related differences in Elwha chum salmon.

Habitat which had significant potential for improvement in chum use was noted during weekly surveys. Field observations revealed that a left-bank side channel, which was a former WDFW index reach for chum salmon (Ray Johnson; retired WDFW biologist; personal communication; March 7, 1994) (Figure 1), appeared to have significant habitat potential for chum salmon but also appeared under-utilized. Hosey and Associates (1989) previously noted that improved access to this side channel could benefit chum salmon.

To describe current habitat conditions in the former WDFW index reach, we conducted a post-season habitat inventory of the entire side channel on March 25, 1994, at a river flow (26 $m^3$/sec; 924 cfs) typical of the chum spawning period. We used a U.S. Forest Service (1990) stream inventory method to survey the channel. We divided the channel into homogeneous sub-reaches based on habitat conditions. Within each sub-reach, we measured wetted area (thalweg length and average width), and qualitatively assessed habitat conditions (i.e., substrate, depth, instream and riparian cover) and likely adult chum access.

## RESULTS and DISCUSSION

Two distinct chum salmon runs may exist within the Elwha River, an early native run and a later hybrid (Walcott/wild) segment, which may be distinguished by spawn-entry timing (John Meyer; National Park Service; personal communication; October 8, 1993). Elwha River tribal catch records for 1989-1993 indicate chum present as early as mid October (Phelps 1994), and one historical Elwha spawner survey conducted on October 29, 1959, reported 24 chum observed (Table 1).

In 1993-1994, chum were first observed in the river by LET surveyors on November 2 and first caught in the tribal fishery November 3; the last spawner observations occurred on January 7 (Table 2, Figure 1). Peak live and total counts occurred from mid November until early December. Redd counts followed a similar trend, although a redd count of 17 on November 12 suggested chum were more numerous earlier in the season than the live counts indicated (Table 2).

Over the season, extreme low flows in October and November may have delayed the early portion of the run, thereby making it difficult to distinguish

two separate stocks based solely on timing observations. Additionally, some fish may have been counted twice from one week to the next and, as a result of extreme high water on December 9, carcasses may have been washed away and some may not have been seen. Visibility remained below 0.3 m after this high water and impaired spawner observations for the remainder of the season (Table 2).

The Walcott-Slough stock spawn-timing peaks in the second week of December (U.S. Fish and Wildlife Service, Western Washington Fishery Resource Office, file data), while other Strait chum salmon stocks range from November through January (Washington Department of Fisheries et al. 1993). In comparison, the 1993-1994 Elwha surveys indicate a possible spawn-timing peak in late November through the first week of December based on live/dead ratios and redd counts (Table 2). An increased redd count on December 29 in the former WDFW index reach suggested a later-timed segment of the chum run was also present.

Surveys conducted during pre-hatchery release years (prior to 1976), when reasonable numbers of chum were observed, suggested peak spawning occurred no later than mid December, and possibly much sooner (Table 1). Live/dead ratios in the former WDFW index reach were relatively even by mid December, and carcass wash-out was unlikely because this side channel was (and still is) largely unaffected by high river flows due to the log jam at its upper end. Given this information, there is still the possibility of determining the origin of present day Elwha River chum based on timing observations in future surveys.

We sampled 21 chum carcasses for electrophoretic analysis (Table 3). These were combined with tribal samples (of the 1993-1994 run) for a total of 62 of the 100-fish target collection. LET divided these samples into early (pre-November 30) and late Elwha based on color and condition of spawners.

Preliminary results suggested a remnant native run may exist (early Elwha) based on its genetic similarity to other Strait of Juan de Fuca stocks, but more samples were needed to firmly establish stock differences in Elwha chum salmon (Phelps 1994).

The total number of chum salmon observed over the season was 230 (including potential repeat observations), with a weekly range of 3 to 43 (Table 2). Our peak count in the former WDFW index reach was 22, occurring in late December. It is highly probable that chum would have utilized this channel earlier in the season had it been accessible, as described below.

In contrast, an area-under-the-curve estimate of abundance using our spawner survey data suggested a 1993-1994 Elwha chum salmon run size of 153 (Jim Uehara, WDFW, personal communication). In this estimate, a 10-day redd life was assumed.

Historically, chum likely much more abundant in the Elwha River than at present. In the post-dam era, a survey conducted on December 1, 1952, found 414 spawners in the former index reach (Table 1). Index surveys conducted in later years show numbers steadily declining until 1992, when a substantial number of chum were encountered in early to mid December (Table 1).

Unquantified reports also indicate that "large numbers" of chum spawners were seen in lower river side channels and below the hatchery outfall during many of the initial years of the LET hatchery program. Unfortunately, no in-river spawner surveys were conducted during this period. Tribal chum harvests peaked in 1987 and declined steadily through 1993, but only non-directed harvests occurred from 1990-1993 (LET Fisheries Office 1994). Chum salmon returns to the hatchery peaked in 1980, declining to near zero in 1985. Hatchery returns were undoubtedly influenced by

varying release strategies, timing of releases, and release locations (LET Fisheries Office 1994).

During the 1993-1994 season, chum spawner distribution was primarily concentrated in the lower half of the survey reach. From November 12 through December 3, 1993, the majority of spawners and redds were found in the lower mainstem, with a few observed in Sisson's Hole and above the former WDFW index reach. On November 26, 31 redds and 23 live chum were observed just below the entrance of the former index reach (Figure 2). From December 17 through December 29, chum were observed exclusively within the former index reach, which became accessible after the December 9th flood (Figure 3). Where mass spawning was observed (e.g., November 26, above), redd counts were less accurate than when isolated redds were encountered.

Habitat survey of the former index reach suggested that two low-flow migratory barriers exist at its lower end which become passable at mainstem flows above approximately 25 $m^3$/sec (900 cfs) (Figure 1, Table 2). These barriers consisted of an old beaver dam and a human-placed line of cobble near the channel's lower confluence with the mainstem. These barriers were not present during spawner surveys conducted by Hosey and Associates in 1989 (Ray Johnson; retired WDFW biologist; personal communication). If the barriers were removed, the channel may become accessible during the entire chum run.

Habitat within the former WDFW index reach was of excellent quality. Substrate consisted primarily of gravel, cobble, and to a lesser extent, small boulder (Table 4). Instream cover in the form of turbulence, depth, and large organic debris was relatively abundant throughout. Riparian vegetation in the form of deciduous trees and shrubs was also relatively abundant. At the time of survey, total wetted area in the side channel measured 37,463 $m^2$ over a total thalweg length of 1,028 m.

## CONCLUSIONS and RECOMMENDATIONS

Chum salmon spawner surveys conducted in the 1993-1994 season, together with reviews of historical spawner surveys, indicated:

1) The 1993-1994 run extended from at least early November through early January. Over the season, we observed most spawners and redds between mid November and early December, with a lesser increase in late December. A peak spawner count of 43 occurred on December 8, and a peak redd count of 47 was observed on November 26. We routinely surveyed up to rkm 5.0, but spawning was only observed up to rkm 4.2 (Sisson's Hole) and was mostly observed in side channels below rkm 3.4. Very low river flows early in the season may have delayed initial entry of the run, while high river flows after December 9 resulted in poor visibility and reduced our ability to accurately census spawners and redds.

2) The 1993-1994 Elwha chum escapement estimate derived by Jim Uehara (WDFW, personal communication, 1994) from the 1993-1994 survey data is 153. This was calculated in part by assuming a 10-day redd life.

3) Historical spawner surveys (pre-LET hatchery program) suggest that peak spawning of native stock occurred no later than mid December, and possibly much sooner, based on index reach counts. This compares with a mid-December peak spawn timing of the Walcott-Slough stock, which was principally used in the hatchery program.

4) Available spawner survey data suggest a decline in naturally spawning chum over the past 40 years, although trend information is limited.

5) Electrophoretic analyses of early (pre-November 30) and late Elwha spawners in the 1993-1994 run suggested that the early segment may be of native origin, but no clear evidence of early and late run segments was evident from the 1993-1994 spawner surveys.

6) Spawner preference for the former WDFW index reach is apparent, and removing low-flow migratory blocks from the downstream entrance of this side channel could benefit Elwha chum salmon.

**We recommend:**

1) Completing one full cycle of spawner surveys to better define run timing, spawner abundance, and spawner distribution, and to gather sufficient samples to complete electrophoretic analyses of early and late segments of the run.

2) Expanding the duration and extent of surveys. Surveys should extend from mid October to early January, and include periodic spot surveys above rkm 5.0. Effort should also be made to mark or note redd locations so that a better population estimate might be made. Special effort should be made to consistently survey the former WDFW index reach throughout the season to improve trend data. A mark-and-recapture estimate of abundance should be considered if mortality due to collection and marking is minimized.

3) Removing the low-flow migratory barriers in the lower end of the former index reach prior to the 1994-1995 chum season. This should increase available high-quality spawning habitat, which may result in higher numbers of chum spawning, ultimately resulting in an increase in the overall population. This action could particularly

benefit the early (possibly native) segment of the Elwha chum run. Additional surveys of the other possible access problems in this side channel should also occur prior to the next season to improve salmon access.

4) Evaluating whether the water diversion at rkm 5.2 permits passage of adult chum salmon. This may be accomplished in part by conducting periodic spot spawner surveys above the diversion in the coming seasons. A passage engineering survey at typical chum passage flows would be useful as well.

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## ACKNOWLEDGEMENTS

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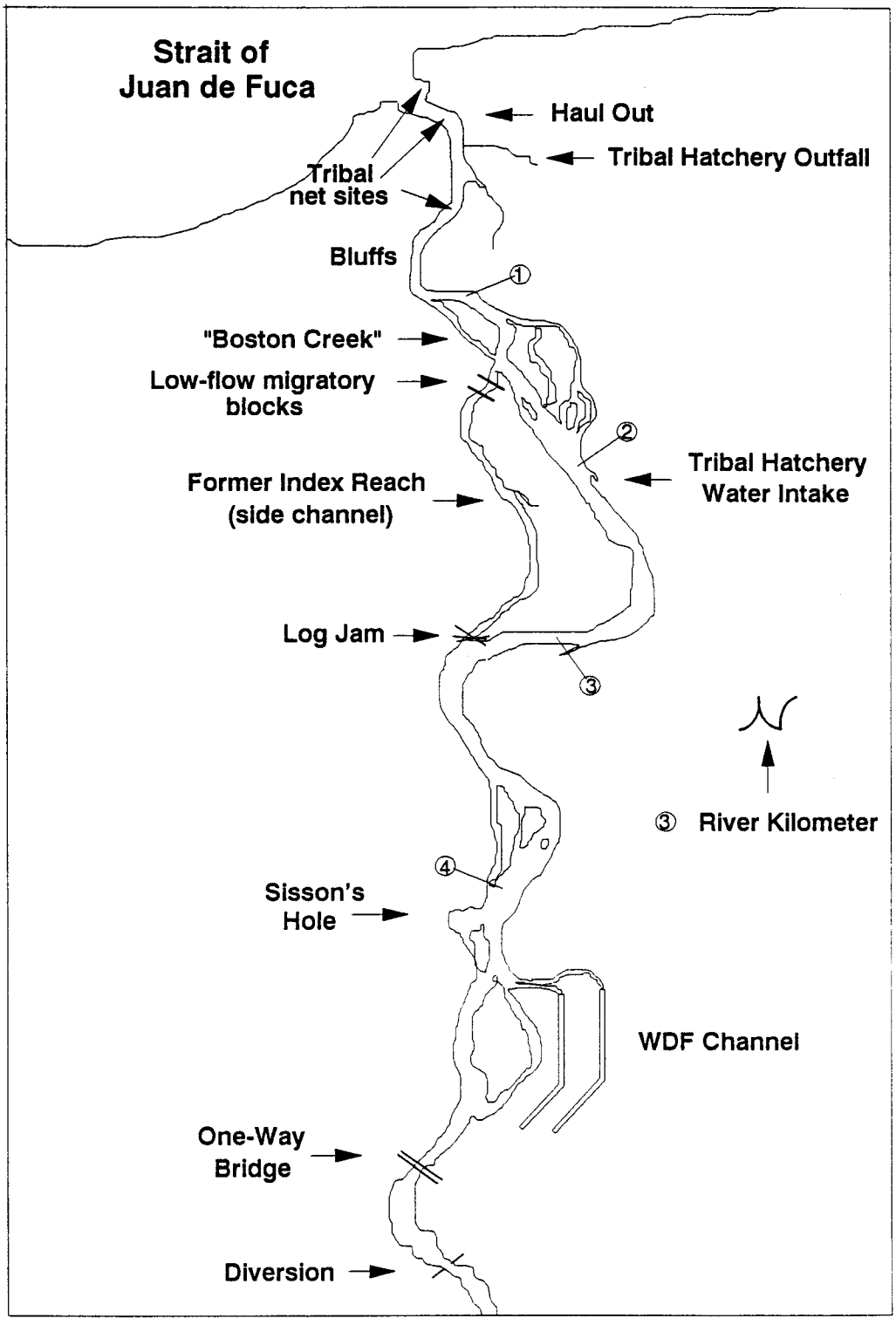


**Figure 1. Lower Elwha River.**

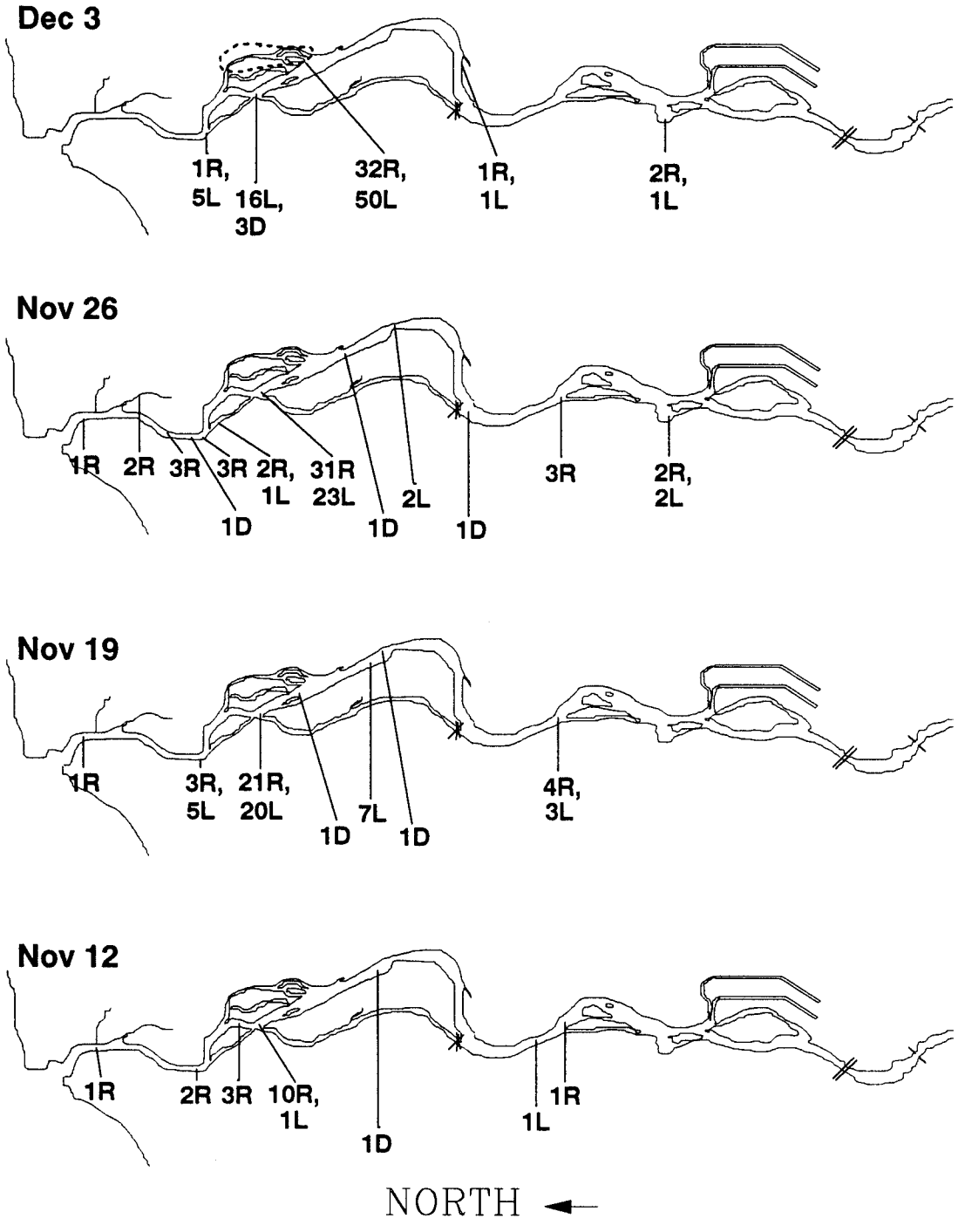


**Figure 2. Chum salmon observations in the lower Elwha River from November 12 to December 3, 1993. (Refer to Figure 1 for landmarks.) R=redd; L=live; D=dead.**

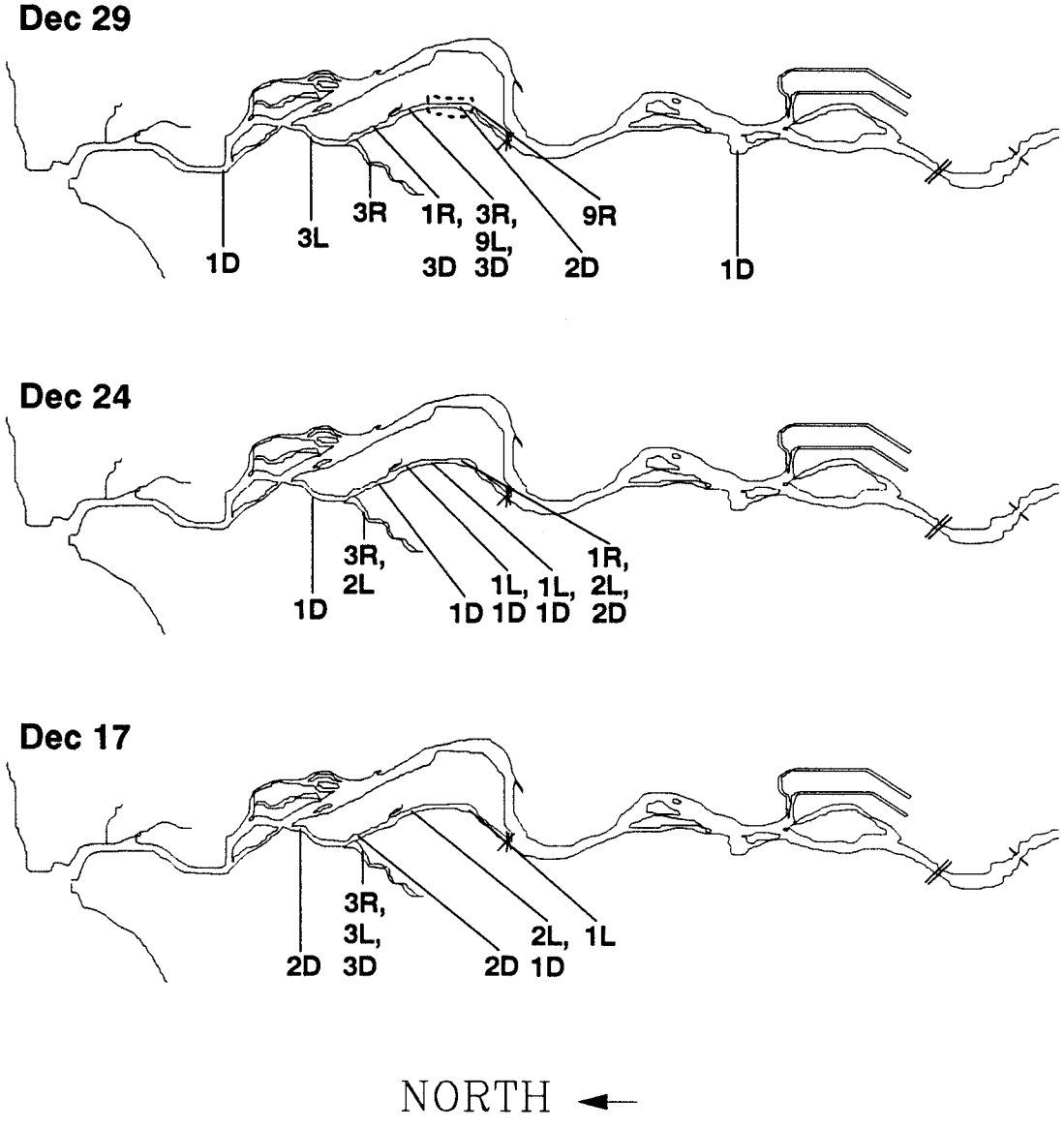


**Figure 3. Chum salmon observations in the lower Elwha River, December 17-29, 1993. (Refer to Figure 1 for landmarks.) R=redd; L=live; D=dead.**

Table 1. Previous chum spawner surveys in the Elwha River (1952-92).

| Date | Location | Stream mile | | Count | | | | Surveyor |
|---|---|---|---|---|---|---|---|---|
| | | Start | End | Live | Dead | Total | No./mile | |
| 11/26/52 | Mainstem | 0.0 | 0.1 | 63 | 42 | 105 | 1050 | WDFW[a] |
| 12/1/52 | Mainstem | 0.0 | 0.7 | 329 | 85 | 414 | 391 | WDFW |
| 12/31/52 | Index[b] | 0.0 | 0.0 | 95 | 250 | 345 | - | WDFW |
| 10/29/59 | Index | 0.0 | 0.5 | 22 | 2 | 24 | 48 | WDFW |
| 11/9/61 | Index | 0.0 | 0.5 | 0 | 0 | 0 | 0 | WDFW |
| 11/28/61 | Index | 0.0 | 0.5 | 72 | 6 | 78 | 156 | WDFW |
| 12/12/62 | Index | 0.2 | 0.5 | 16 | 18 | 34 | 170 | WDFW |
| 12/12/63 | Index | 0.0 | 0.5 | 22 | 25 | 57 | 114 | WDFW |
| 12/8/64 | Index | 0.0 | 0.3 | 3 | 2 | 5 | 17 | WDFW |
| 11/30/65 | Index | 0.0 | 0.5 | 9 | 1 | 10 | 20 | WDFW |
| 12/17/65 | Index | 0.0 | 0.5 | 11 | 13 | 24 | 48 | WDFW |
| 12/10/66 | Index | 0.0 | 0.3 | 5 | 2 | 7 | 23 | WDFW |
| 11/30/70 | Index | 0.0 | 0.3 | 8 | 1 | 9 | 30 | WDFW |
| 11/24/72 | Index | 0.0 | 0.3 | 0 | 1 | 1 | 3 | WDFW |
| 10/2/89 | Mainstem[c] | 0.0 | 3.0 | 0 | 0 | 0 | 0 | HO[d] |
| 10/9/89 | Mainstem | 0.0 | 3.0 | 0 | 0 | 0 | 0 | HO |
| 10/16/89 | Mainstem | 0.0 | 1.0 | 0 | 0 | 0 | 0 | HO |
| 10/23/89 | Mainstem | 0.0 | 1.5 | 0 | 0 | 0 | 0 | HO |
| 10/26/89 | Mainstem | 0.0 | 3.0 | 0 | 0 | 0 | 0 | HO |
| 11/7/89 | Mainstem[e] | 0.2 | 3.2 | 5 | 1 | 6 | 2 | HO |
| 11/20/89 | Mainstem[e] | 0.0 | 0.5 | 7 | 0 | 7[f] | 23 | HO |
| 11/29/89 | Mainstem | 0.0 | 1.5 | 14 | 1 | 15[f] | 10 | HO |
| 12/18/89 | Mainstem[g] | 0.0 | 1.5 | 11 | 3 | 14[fg] | 9 | HO |
| 1/4/90 | Mainstem | 0.0 | 1.5 | 0 | 5 | 5[fg] | 3 | HO |
| 11/19/92 | Mainstem[h] | - | - | 0 | 2 | 2 | - | NPS[i] |
| 11/22/92 | SC[j] | - | - | 0 | 3 | 3 | - | NPS |
| 12/3/92 | SC[j] | - | - | 100 | 38 | 138 | - | NPS |
| 12/14/92 | SC[j] | - | - | 58 | 138 | 196 | - | NPS |

Table 1. Continued.

[a] WDFW salmon spawning ground survey data.
[b] Former WDFW index reach (left-bank side channel due south of Boston Creek).
[c] Mainstem float from one-way bridge to hatchery outfall, all wetted side channels surveyed by foot.
[d] Hosey and Associates (Allan Solonsky; personal communication; March 7, 1994).
[e] Chum only observed in right-bank side channel 0.5 miles above river mouth.
[f] Count likely to be conservative due to low visibility.
[g] Chum observed in former WDFW index reach and in right-bank side channel 0.5 miles above river mouth.
[h] Chum observed at river mouth.
[i] National Park Service (John Meyer; personal communication; October 8, 1993).
[j] Chum observed in former WDFW index reach - spot surveys only.

Table 2. Chum salmon surveys conducted in 1993-1994. Tribal spot surveys and hatchery rack recoveries are also noted (tribal data source: LET Fisheries Office).

| Date | Count | | | | Streamflow[b] | | | Comments |
|---|---|---|---|---|---|---|---|---|
| | Live | Dead | Total[a] | Redds | (cfs) | ($m^3$/sec) | Water visibility (m) | |
| Nov 2[c] | 4 | 2 | 6 | - | 351 | 10 | - | |
| Nov 3[c] | 1 | 0 | 1 | - | 447 | 13 | - | Four chum also caught in tribal fishery. |
| Nov 4[c] | 1 | 1 | 2 | - | 296 | 8 | - | Three chum also caught in tribal fishery. |
| Nov 5 | 0 | 0 | 0 | 0 | 288 | 8 | 3 | Survey stopped at rkm 2.1. Two chum also caught in tribal fishery. |
| NOV 8[c] | 0 | 0 | 0 | - | 245 | 7 | - | |
| Nov 12 | 2 | 1 | 3 | 17 | 216 | 6 | 3 | One chum into hatchery. |
| Nov 15[c] | 0 | 1 | 1 | - | 319 | 9 | - | |
| Nov 19 | 35 | 2 | 37 | 29 | 214 | 6 | 3 | |
| Nov 23[c] | 0 | 0 | 0 | - | 279 | 8 | - | |
| Nov 26 | 28 | 3 | 31 | 47 | 261 | 7 | 3 | Mass spawning observed at rkm 1.4 left bank above Boston Creek. |
| Nov 29[c] | 0 | 1 | 1 | - | 642 | 18 | - | Seven chum into hatchery. |
| Dec 3 | 23 | 3 | 26 | 4 | 2,266 | 64 | 1 | An estimated 50 live chum and 32 chum redds also observed by LET on right bank side channels from rkm 1.3 to 1.8. |
| Dec 6[c] | 20 | 2 | 22 | - | 789 | 22 | - | |

| Date | Count | | | | Streamflow[b] | | Water visibility (m) | Comments |
|---|---|---|---|---|---|---|---|---|
| | Live | Dead | Total[a] | Redds | (cfs) | ($m^3$/sec) | | |
| Dec 7[c] | - | - | - | - | 775 | 22 | - | Three chum into hatchery. |
| Dec 8[c] | 40 | 3 | 43 | - | 956 | 27 | - | |
| Dec 10 | - | - | - | 0 | 7,557 | 214 | nil | No survey due to high water. |
| Dec 13[c] | - | - | 0 | - | 2,580 | 73 | - | One chum into hatchery. |
| Dec 17 | 6 | 8 | 14 | 3 | 1,133 | 32 | <0.3 | |
| Dec 20[c] | 0 | 1 | 1 | - | 866 | 24 | - | |
| Dec 21[c] | 0 | 1 | 1 | - | 824 | 23 | - | |
| Dec 24 | 6 | 6 | 12 | 4 | 686 | 19 | <0.3 | |
| Dec 29 | 12 | 10 | 22 | 16 | 592 | 17 | <0.3 | |
| Jan 3[c] | 0 | 5 | 5 | - | 1733 | 49 | - | Only former WDFW index reach surveyed due to high flow. |
| Jan 7 | - | - | - | - | 1,557 | 44 | nil | No survey conducted. |
| Jan 7[c] | 0 | 2 | 2 | - | 1,557 | 44 | - | Carcasses in "Sissons Hole". |
| Jan 14 | 0 | 0 | 0 | 0 | 1,160 | 33 | <0.3 | |

[a] Live and dead count.
[b] Discharge measured at Glines Canyon Dam.
[c] Tribal spot survey or hatchery rack recovery.

Table 3. Scale and electrophoretic (GSI) samples collected in 1993-1994 by U.S. Fish and Wildlife Service and combined with tribal samples for GSI analysis.

| Date | Sample location (Rkm) | | Sample number | | GSI tissue sample[a] |
|---|---|---|---|---|---|
| | Main-stem | Side channel | Scale | GSI | |
| Nov 12 | 2.1 | | 1 | 13 | Muscle only. |
| Nov 19 | 2.1 | | 1 | 17 | |
| | 1.5 | | 2 | 18 | |
| Nov 26 | 3.5 | | 1 | 19 | |
| | 2.1 | | 2 | 20 | |
| | 0.8 | | 3 | 21 | |
| Dec 3 | | 3.5 | 1 | 8 | |
| Dec 17 | | 3.5 | 1 | 9 | |
| | | 3.5 | 2 | 10 | |
| | | 3.5 | | 11 | |
| | | 3.5 | 4 | 12 | |
| | | 3.5 | 5 | 13 | |
| Dec 24 | | 1.6, LB | 1 | 14 | |
| | | 1.7, LB | | 15 | |
| | | 1.8, LB | 2 | 16 | |
| | | 2.0, LB | 3 | 17 | Eye only. |
| Dec 29 | | 1.7, LB | | 18 | Muscle only. |
| | | 1.7, LB | | 19 | Muscle, heart only. |
| | | 2.0 | 1 | 20 | Muscle only. |
| | | 2.3 | | 21 | Muscle only. |
| | | 2.3 | 2 | 22 | Muscle only. |

[a] All GSI tissues (muscle, heart, eye, and liver) were sampled except as noted.

Table 4. Habitat survey of former WDFW index reach, conducted on March 25, 1994, in upstream direction.

| Sub-reach | Length (m) | Mean width (m) | Max. depth (m) | Substrate | | Comments |
|---|---|---|---|---|---|---|
| | | | | Dominant | Sub-dom. | |
| 1 | 36.3 | 20.3 | 0.3 | gravel | cobble | Rock barrier. |
| 2 | 25.0 | 27.0 | 0.3 | sand | cobble | |
| 3 | 48.8 | 5.6 | 0.4 | cobble | small boulder | |
| 4 | 31.1 | 13.7 | 1.0 | gravel | sand | Beaver dam barrier. |
| 5 | 45.7 | 13.3 | >1.5 | sand | gravel | |
| 6 | 76.2 | 9.6 | 0.5 | gravel | cobble | |
| 7a | 18.0 | 6.7 | 0.5 | gravel | cobble | Channel split by gravel bar. |
| 7b | - | 7.9 | 0.5 | cobble | gravel | |
| 8 | 38.1 | 7.3 | 0.6 | gravel | cobble | |
| 9 | 28.9 | 4.1 | 0.7 | gravel | cobble | |
| 10 | 23.7 | 11.0 | 0.6 | gravel | sand | Passable log jam. |
| 11 | 114.3 | 18.4 | 0.6 | gravel | sand | |
| 12 | 53.3 | 8.8 | 0.35 | cobble | gravel | |
| 13 | 57.9 | 9.1 | 0.5 | gravel | cobble | Spawning limit. |
| 14 | 15.5 | 10.7 | 0.5 | gravel | sand | |
| 15 | 36.5 | 6.0 | 0.5 | gravel | cobble | |
| 16 | 15.0 | 10.8 | 0.8 | gravel | cobble | |
| 17 | 27.0 | 9.1 | 1.1 | gravel | cobble | Side pool. |
| 18 | 39.0 | 10.7 | 0.4 | gravel | cobble | |
| 19 | 140.5 | 41.5 | >1.0 | gravel | cobble | |
| 20 | 39.0 | 8.8 | 0.6 | gravel | cobble | |
| 21a | 30.5 | 2.7 | >1.0 | cobble | small boulder | Channel split by gravel bar. |
| 21b | - | 7.6 | 0.3 | gravel | cobble | |
| 22 | 88.4 | 18.3 | 0.6 | gravel | cobble | Upstream end. |
| Overall: | 1028.1 | 34.9 | | | | |